Strap tensioner and associated gripping jaws

The invention relates to a strap tensioner having a tensioning strap and a tensioning device with a winding body for the tensioning strap, having a toothed locking wheel which is associated with the winding body and in the locking toothing arrangement of which a driving pawl, associated with a driving lever, and a locking pawl engage, in order, by way of repeated pivoting of the driving lever, to rotate the winding body with directional locking.

Such a strap tensioner is known from DE 202 04 955 U1. The winding body here is in the form of a slotted shaft. The tensioning strap is pulled through the diametral slot of this shaft. When the winding body is rotated, the strap winds up around the winding body, the free end of the strap remaining loose.

EP 0 730 932 B1 discloses a strap tensioner in which the strap can be tensioned by means of a double pulley. The tensioning device has a storage pulley on which the strap which is not required can be wound up. A crank is provided for this purpose.

Taking the prior art mentioned in the introduction as the departure point, it is the task of the invention to develop the strap tensioner of the generic type in a functionally advantageous manner. The object is achieved by the invention specified in the claims.

Claim 1 provides, first and foremost, that the winding body has a spring accumulator acting in the winding-up direction and, as a storage reel, accommodates substantially the entire length of the strap, which has one end connected fixedly to the winding body. To supplement this, it is proposed that the driving lever and a handle, which is connected fixedly to a

tensioning-device housing, are associated with one another in a tong-like manner. Furthermore, the apparatus may have a release lever which is associated, in particular, with the handle and is intended for releasing the locking pawl. It is possible for the driving lever, for the purpose of applying the tensioning force, to be displaced in the direction of the handle counter to the force of a restoring spring. In the rest position, it is possible for the driving pawl not to be in engagement with the locking teeth. The locking wheel is then locked just by the locking pawl. If the locking pawl is released, then the force of the spring accumulator is capable of winding up the strap automatically when the driving lever is located in the rest position. The locking pawl located in the locking position prevents this winding-up action. The winding body may consist of plastics material. It may be disposed in a housing which is closed all the way round, the housing having a through-passage slot for the tensioning strap and, if appropriate, an operating opening for the driving pawl. That end of the tensioning strap which is not connected fixedly to the winding body may be provided with a hook. This hook can be hooked onto the housing. The locking wheel may consist of metal, preferably steel. It is of annular configuration. It is positioned in a form-fitting manner in the end wall of the winding body. The winding body preferably has two locking wheels which are each positioned in a form-fitting manner in the two opposite end walls of the winding body. The driving lever may have fork-like arms. By means of the latter, the driving lever can be articulated on the outside of the housing. The articulation axis here preferably corresponds to the axis of rotation of the winding body.

The winding body is capable of accommodating the entire length of the tensioning strap. Winding up takes place automatically when the driving pawl and the locking

pawl are moved out of toothing engagement. By virtue of the tensioning strap being pulled, the latter can be pulled off from the winding body again. When the tensioning strap is pulled off from the winding body, the winding body is rotated. This rotation is accompanied by stressing of a spiral spring which is disposed in a cavity of the winding body. When the driving pawl, in the rest position of the driving lever, is not in toothing engagement, all that is required, in order to wind up and/or pull out the strap, is to actuate the release lever, by means of which the locking pawl is rendered inactive.

The invention also relates to a gripping jaw, a total of four of these being associated with the tensioning strap. Each gripping jaw has two angled legs. On the outside of the angled legs, the gripping jaw has devices for securing in a longitudinally displaceable manner on a tensioning strap. These devices may be formed by guiding cross-pieces which at least partially enclose the tensioning strap. With their insides, the angled legs form gripping jaws for butting against a workpiece in the angled region. According to the invention, it is provided that the two legs are associated with one another in a pivotable manner. As a result of this configuration, it is possible to fit the gripping jaws not just at right-angled corners of a workpiece, but also at obtuse-angled corners of a workpiece. The two angled legs are preferably connected integrally to one another to form a film hinge. This is advantageous, in particular, when the tensioning strap is to be used to tension a mitre joint. The tips of the two mitred legs which are to be glued to one another then butt against the hinge leg. This rules out any slippage. Each of the two angled legs preferably has peripheral stiffening ribs. The tensioning strap is located between these two stiffening ribs. Wedged ribs may also be disposed between the two stiffening ribs, the wedge tips being oriented toward the film hinge.

The film-hinge ends of the stiffening ribs are lengthened such that they overlap in the 90° position. The overlapping regions may have stop edges which, in the opened-out position, act on counter stops of the respectively other angled leg.

An exemplary embodiment of the invention is explained hereinbelow with reference to attached drawings, in which:

Figure 1 shows the strap tensioner according to the invention in plan view, with four associated gripping jaws,

Figure 2 shows an enlarged illustration of the strap tensioner according to Figure 1 in plan view, with the housing cover removed, in the non-actuated position, in which the driving pawl 7 is not in toothing engagement, but the locking pawl is in toothing engagement,

Figure 3 shows an illustration according to Figure 2 with the driving lever displaced slightly, with the result that the driving pawl comes into toothing engagement,

Figure 4 shows a follow-up illustration to Figure 3 with the driving lever 6 displaced toward the handle 11,

Figure 5 shows a follow-up illustration to Figure 2 with release levers 12 actuated,

Figure 6 shows a side view as seen from the direction of arrow VI in Figure 1,

Figure 7 shows an enlarged illustration according to Figure 1 with one arm 18 of the driving lever 6 broken away in the region of its

point of articulation,

Figure 8 shows a section along line VIII-VIII in Figure 1,

Figure 9 shows a gripping jaw in side view in its 90° position and, using chain-dotted lines, in an obtuse-angled pivoted position,

Figure 10 shows a view in the direction of the arrow X in Figure 9,

Figure 11 shows a view in the direction of arrow XI in Figure 9,

Figure 12 shows a section along line XII-XII in Figure 10, and

Figure 13 shows an enlarged detail according to region XIII in Figure 12.

The basic construction of the strap tensioner is shown in Figure 1. The strap tensioner has a tensioning device 3, which has a housing 10 in which a winding body 2 is disposed. A handle 11 is connected fixedly to the housing 10. A release lever 12 is provided in the region of connection to the housing. The driving lever 6 has, in a fork-like manner, two arms 18, by means of which it is secured in a pivotable manner on the housing 10.

The tensioning strap 1 can be wound up on the winding body 2. Four gripping jaws 40 are seated on the tensioning strap. The free end of the tensioning strap 1 has a hook 15 which can be hooked around a pin 16, which is fixed to the housing 10.

The elements of the strap tensioner can be gathered, in particular, from Figures 2 and 9. The winding body 2

consists of plastics material. It has an inner cavity 38 and can be rotated about a journal, which is connected fixedly to the base 36 of the housing 10. The journal 23 has a diametral slot. One end 9' of a flat spiral spring 9 is secured in this diametral slot. The other end 9'' of the flat spiral spring 9 is secured on the wall of the cavity 38 of the winding body 2. On the outside, the winding body 2 forms an annular storage space for the strap 1. The storage space is flanked by the two end walls 17 of the winding body 2.

If the tensioning strap 1 has been wound up fully onto the winding body. If the flat spiral spring 9, which is located beneath a covering 39, is prestressed to a slight extent. If the tensioning strap 1 is pulled off from the winding body 2, then this is associated with rotation of the winding body 2. This rotation is accompanied by stressing of the spring accumulator 9 formed by the flat spiral spring. The winding body 2 rotates about the journal 23 in this case.

On their sides which are oriented away from one another, the two end walls 17 form recesses for accommodating a respective locking wheel 4. Each locking wheel 4 consists of a punched steel part and has a locking toothing arrangement on the outside. On the inside, each locking wheel 4 has a recess 28, in which protrusions 29 of the end side 17 engage in a form fitting manner in order to ensure rotationally fixed connection of the locking wheel 4 to the winding body 2. The locking wheels 4 may well be positioned loosely in the recesses associated with them. The base 36 of the housing 10 forms an annular spacer bead 34, on which the locking wheel 4 slides.

The other locking wheel 4 is borne by the housing cover 21. The housing cover 21 is secured on the housing 10 by means of fastening screws 32. In the center, the housing cover 21 forms an opening into which the free

end of the journal 23 projects. The bearing base 22, which encloses the journal 32, projects into the cavity 38 of the winding body 2 and thus likewise serves for the rotational mounting of the winding body 2.

The cover 21, furthermore, has a central bearing portion 37 for one arm 18 of the fork-like driving lever 6. The other arm 18 of the fork-like driving lever 6 is mounted such that it can be pivoted about a bearing portion 35 of the housing base.

The housing base 36 forms, in the manner of a pin, a pivot axis 30 for the release lever 12. An actuating portion of the release lever 12 projects through an opening of the housing in order to be actuated from the outside. If the actuating portion of the release lever 12 is actuated, then a locking pawl 8 is pivoted. This takes place counter to the restoring force of a locking-pawl spring 27, which is supported on an abutment 31 of the housing. In the exemplary embodiment, the locking-pawl spring 27 is formed by a leg spring and the locking pawl 8 is formed by a metal component which, in the locking position, engages in the toothing arrangement 5 of the two locking wheels 4. The strength of the locking-pawl spring 27 is such that, when the locking pawl 8 is located in the toothing arrangement 5, the spring accumulator 9 is not capable of rotating the winding body 2. The locking pawl 8 thus does not just form a lock against the strap 1 being pulled out, but also inhibits rotation.

The driving lever 6 carries a driving pawl 7. The outer portions 7' of the driving pawl 7 are guided in slots 20 of the driving-lever arms 18. By means of its locking edge 7'', the driving pawl 7 is capable of engaging in the toothing arrangement of the locking wheels 4. Pivoting of the driving lever 6 then results in the winding body 2 being rotated in the tensioning direction.

As Figure 7 shows, the driving lever 6 is retained by means of a restoring spring 13 in a rest position, in which it is spread apart from the handle 11. The restoring spring 13 is a leg spring, the end 13' of which engages in an opening of the driving-lever arm 18. The leg spring 13 as such is located in a recess 19 of the housing cover. The other end 13'' of the restoring spring 13 is supported on the wall of this recess 19.

As can be gathered from Figure 2, the periphery of an operating opening 52 has a drive protrusion 25. This drive protrusion 25 drives an angled portion 24, which forms a drive slope of the driving pawl 7 such that the locking edge 7'' of the driving pawl 7, in the rest position (Figure 2), does not engage in the toothing arrangement 5 of the locking wheel 4. Figure 2 also shows the compression spring 26, which biases the driving pawl 7, under spring force, in the direction of the locking wheel 4. The through-passage slot 14 for the tensioning strap can also be seen in this figure.

The strap tensioner functions as follows:
In an operating position which is not illustrated, the entire tensioning strap 1 has been wound up on the winding body 2. It is also possible, however, for the starting position to be the position illustrated in Figure 1, in which the tensioning strap is positioned loosely around a workpiece, which is illustrated by chain-dotted lines there, and the hook 15 is hooked into the pin 16. The gripping jaws 40, which are designated by the reference numeral 40, are associated with the corners of the workpiece.

Starting from this functional position, in which the locking-pawl mechanism assumes the position which is illustrated in Figure 2, the driving lever 6 is displaced in the direction of the handle 11. In this

case, the drive slope of the driving pawl, this slope being formed by the angled portion 24, slides off from the drive protrusion 25. The compression spring 26 displaces the driving pawl 7 in the direction of the toothing arrangement such that the edge 7'' engages in the toothing arrangement 5. Starting from this functional position, which is illustrated in Figure 3, the driving lever 6 is then displaced further in the direction of the handle 11, as is illustrated in Figure 4. This is accompanied by the winding body 2 being carried along in rotation in the arrow direction. The tensioning strap 1 is wound up on the winding body 2, the strap tensioning being increased simultaneously. If, once the driving lever 6 has been pulled right up to the handle 11, the driving lever 6 is released, then the force of the restoring spring 13 ensures that the driving lever 6 is displaced back into the starting position illustrated in Figure 2. The locking pawl 8 here secures the locking wheel. The edge 7'' of the driving pawl 7 here slides over the sloping surfaces of the toothing arrangement 5.

By virtue of this previously described rotary actuation of the pawl-locked winding body 2 being repeated a number of times, the strap is tensioned in a known manner.

The tensioning is released by virtue of the release lever 12 being pressed. This takes place in the position illustrated in Figure 5, in which the drive protrusion 25 has driven the driving pawl 7 out of toothing engagement, and it is thus possible, by virtue of the tensioning strap 1 being pulled, for the winding body to be rotated in the arrow direction illustrated in Figure 5. This rotation is accompanied by the spring accumulator 9 being stressed. If, the operating position illustrated in Figure 5, the tensioning strap is not subjected to pulling, then the spring accumulator 9 is capable of rotating the winding body 2

counter to the arrow direction illustrated in Figure 5, which results in the tensioning strap 1 being wound up automatically on the winding body.

In the tensioning position, it is possible for a planar outer housing surface 10' to be positioned against the workpiece.

Figures 9 to 13 show a gripping jaw 40 in detail. This gripping jaw comprises a plastics injection molding. The gripping jaw has two angled legs 41 which are connected to one another to form a film hinge 44. The two angled legs 41 form, on the inside, gripping surfaces 43 which can be moved in relation to one another from a 90° position into an opened-out position.

Peripheral stiffening ribs 45 are located to the rear of the gripping surfaces 43. The tensioning strap 1 is guided between the two stiffening ribs 45 of each angled leg 41. Guiding cross-pieces 42 project toward one another from each stiffening rib 45 and engage over the peripheral portion of the strap 1 in order to secure the latter in a longitudinally displaceable manner on the gripping jaw 40.

A multiplicity of wedged ribs 47 are also located between the two stiffening ribs 45. These wedged ribs extend, at their tips, from the film hinge 44. The tensioning strap 1 is guided on the wedged ribs 47.

The film-hinge ends of the stiffening ribs 45 form overlapping portions 49. The overlapping portions 49 form stop edge 50. In an operating position which is not illustrated, the stop edges 50 can be brought into abutment against counter stops 51 of the respectively other angled leg 41. In addition, the stiffening ribs 45 also have openings 46 which are circular in plan view and have different diameters.

As can be gathered from Figure 1, the stiffening ribs 45 have cavities 48.

All features disclosed are (in themselves) pertinent to the invention. The disclosure content of the associated/attached priority documents (copy of the prior application) is hereby also included in full in the disclosure of the application, also for the purpose of incorporating features of these documents in claims of the present application.